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(71) Applicant: **Casio Computer Co., Ltd.**
Tokyo 151-8543 (JP)

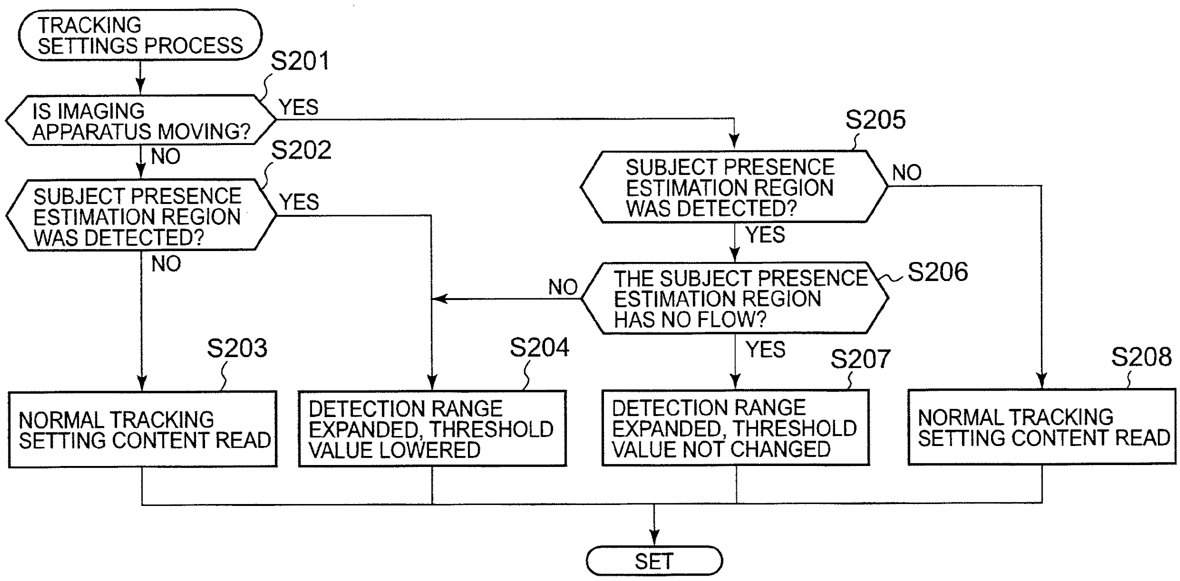
(72) Inventor: **Matsumoto, Kosuke**
Hamura-shi Tokyo 205-8555 (JP)

(74) Representative: **Grünecker, Kinkeldey, Stockmair & Schwanhäusser**
Anwaltssozietät
Leopoldstrasse 4
80802 München (DE)

(54) Imaging apparatus, subject tracking method and storage medium

(57) If there is no movement of the imaging apparatus and no subject presence estimation region, normal tracking setting is accomplished (step S203), while if there is a subject presence estimation region, tracking setting is accomplished by expanding the detection range and lowering the detection threshold value (step S204). If the imaging apparatus is moving and there is no subject presence estimation region, normal tracking settings are accomplished (step S208), while if there is a subject presence estimation region, a determination is made as to whether or not that region is one with no flow (movement vector) detected. If this is a region with no flow detected, tracking settings are accomplished by expanding the detection range and using normal detection threshold values (step S207). If there is a region with flow detected, tracking settings are made by expanding the detection range and lowering the detection threshold value (step S204).

FIG. 4



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Description

[0001] This application relates generally to an imaging apparatus, a subject tracking method and a storage medium on which programs are recorded.

[0002] Imaging apparatuses equipped with a function that successively detects the position of a moving subject have been known from before. For example, there is technology that tracks a subject using template matching (also called block matching). For example, the image monitoring apparatus disclosed in Patent Literature 1 (Unexamined Japanese Patent Application KOKAI Publication No. 2001-076156) searches for a small image region resembling a template cut from an image of a previous frame (an image containing the subject that is to be tracked) from the search range of this frame image. Through this search, the image monitoring apparatus detects small image regions with the greatest similarity to the template and then determines that the subject has moved within the detected small image region. In addition, when the frame image is captured anew, this image monitoring apparatus repeats the above actions after renewing the detected small image region as the template. By repeating this, the image monitoring apparatus successively detects (tracks) to what position the subject has moved relative to each frame image successively captured.

[0003] However, the image monitoring apparatus disclosed in Patent Literature 1 accomplishes block matching using the same search conditions regardless of the behavior of the subject. Consequently, the art disclosed in Patent Literature 1 has the problem that, for example, block matching suitable for the behavior of the subject in the frame image cannot be accomplished.

[0004] Specifically, in this art there is a problem of unnecessary calculation amounts increasing when there is a wide angle of view such as in wide-angle imaging, and when there is virtually no movement of the subject. In addition, in this art when there are narrow angle of views such as in telephoto imaging while movement of the subject is severe, there is a high likelihood that the subject will deviate from the search range, creating the problem that the subject cannot be tracked.

[0005] The present invention addresses the above problem and seeks to attain an imaging apparatus, a subject tracking method and a storage program that can accomplish subject tracking suited to the subject's behavior without being influenced by the angle of view.

In order to solve the above problem, a configuration of the present invention is characterized by being provided with an imaging unit (8), a determination unit (16) that determines an imaging scene on the basis of change between images successively captured by the imaging unit, and a control unit (16)that controls tracking of a subject region contained in the image captured by the imaging unit on the basis of the determination results from the determination unit.

In order to solve the above problem, a configuration of the present invention is a subject tracking method characterized by comprising an imaging step in which images are successively captured in the imaging unit, a determination step that determines an imaging scene on the basis of change between images successively captured in the imaging step, and a control step that controls tracking of a subject region contained in the captured image on the basis of determination results from that determination step.

With the present invention, it is possible to track a subject more ideally than in the past on the basis of the imaging scene.

[0006] A more complete understanding of this application can be obtained when the following detailed description is considered in conjunction with the following drawings, in which:

FIG. 1A is a front view showing one example of the outside of an imaging apparatus **1** according to the present invention;

FIG. 1B is a rear view showing one example of the outside of an imaging apparatus **1** according to the present invention;

FIG. 2 is a block diagram showing one example of the schematic composition of the imaging apparatus 1;

FIG. 3 is a flowchart showing one example of the operation of the imaging apparatus 1;

FIG. 4 is a flowchart showing one example of the process for detecting optical flow executed by the imaging apparatus 1;

FIG. 5A is a figure showing one example of the prior image captured by the imaging apparatus **1;**

FIGS. 5B-F are figures showing examples of current frame image captured by the imaging apparatus **1;**

FIGS. 6A-E are figures showing examples of the optical flow the imaging apparatus **1** detects from the captured image; and

FIG. 7 is a table showing one example of the scene when the imaging apparatus **1** captures the image.

[0007] The imaging apparatus according to the preferred embodiment of the present invention will be described hereafter with reference to the drawings. FIG. 1A is a front view of the outside of an imaging apparatus 1 according to this embodiment, and FIG. 1B is a rear view. The imaging apparatus 1 is provided on the front with an imaging lens 2 and on the top with a shutter key 3. This shutter key 3 is equipped with a so-called half-shutter function enabling it to be halfway depressed or fully depressed. In addition, the imaging apparatus 1 is provided on the back surface with a function key 4, a cursor key 5 and a display unit 6. The cursor key 5 functions as a rotary switch rotatable in direction "a" in FIG. 1B. Display unit 6 is composed of an LCD (liquid crystal display) with a 16:9 aspect ratio, for example.

[0008] FIG. 2 is a block diagram showing the schematic composition of the imaging apparatus 1. The imaging apparatus 1 is composed of the imaging lens 2, the key input units 3-5, the display unit 6, a drive controller 7, an imaging unit 8, a unit circuit 9, an image processor 10, an encoding/decoding processor 11, a preview engine 12, an image storage unit 13, a program memory 14, RAM (random access memory) 15, a CPU 16, a camera-shake detector 17 and a bus line 18.

[0009] The CPU 16 is a one-chip microcomputer that controls the various components of the imaging apparatus 1. The imaging apparatus 1 according to this embodiment detects the subject from inside the image captured by the imaging apparatus 1 and tracks that subject. The CPU 16 controls the various components of the imaging apparatus 1 in order to execute that action.

[0010] The imaging lens 2 is a lens unit composed of a plurality of lenses on which are mounted optical system members provided with a zoom lens, a focus lens, etc. The CPU 16, upon detecting the photographer's zoom operation or the photographer's half-pressing of the shutter key 3, accomplishes an auto focus (AF) process and sends control signals to the drive controller 7 to control the drive controller 7. The drive controller 7 causes the position of the imaging lens 2 to move on the basis of those drive signals.

[0011] The key input units 3-5 send to the CPU 16 operation signals in accordance with operation of the shutter key 3, the function key 4 and the cursor key 5.

[0012] The imaging unit 8 is composed of an imaging sensor such as a CMOS (complementary metal oxide semiconductor) and is positioned on the optical axis of the above-described imaging lens 2.

[0013] The unit circuit 9 is a circuit into which an analog imaging signal is input corresponding to the optical image of the subject output from the imaging unit 8. The unit circuit is composed of an automatic gain control (AGC) amplifier that amplifies the imaging signal accompanying the automatic exposure (AE) process and correlated double sampling (CDS) that preserves the input imaging signal. Furthermore, the unit circuit 9 is composed of an analog/digital converter (ADC) that converts the amplified imaging signals into digital imaging signals. The image processor 10 performs various types of image processing on the imaging signals sent from the unit circuit 9.

[0014] The imaging signal output from the imaging unit 8 is sent to the image processor 10 as a digital signal after passing through the unit circuit 9. That digital signal (imaging signal) undergoes various types of image processing in the image processor 10. Moreover, the digital signal (imaging signal) on which various types of image processing have been performed is compressed in the preview engine 12 and supplied to the display unit 6. Furthermore, when the supplied digital signal (imaging signal) and the drive control signal that drives the driver built into the display unit 6 are input into the display unit 6, the display unit 6 gives a live-view display of the image based on the digital signal (imaging signal).

[0015] An image file is recorded in the image storage unit 13. The image storage unit 13 may be a memory built into the imaging apparatus 1 or may be a removable memory. When recording images, imaging signals processed by the image processor 10 are compressed and encoded by the encoding/decoding processor 11, made into files using a predetermined file format such as JPEG, and recorded on the image storage unit 13. On the other hand, image files read from the image storage unit 13 when playing back images are decoded by the encoding/decoding processor 11 and displayed on the display unit 6.

[0016] The preview engine 12 creates images for the above-described preview display. In addition, the preview engine 12 accomplishes the necessary control when an image is displayed on the display unit 6 immediately prior to being recorded on the image storage unit 13 at the time of image recording.

[0017] The programs for executing processes shown in the later-described flowcharts are stored in the program memory 14. The RAM 15 temporarily stores continuously captured images. The camera-shake detector 17 detects vibrations caused by shaking of the photographer's hands and sends the detected results to the CPU 16. The bus line 18 connects the various components of the imaging apparatus 1 and transmits data back and forth between these components.

[0018] The actions of the imaging apparatus 1 will be described hereafter. When the CPU 16 detects an instruction to start the imaging mode through a predetermined operation of the function key 4 or the cursor key 5, the CPU 16 reads and executes programs relating to the subject tracking mode from the program memory 14 as shown in the flowchart in FIG. 3.

[0019] In subject tracking mode, first the imaging unit 8 outputs the analog imaging signal corresponding to the optical image of the whole angle of view to the unit circuit 9 with a predetermined period. Furthermore, the unit circuit 9 converts the input analog imaging signal into a digital signal. The CPU 16 creates image data on the image processor 10 from that digital signal. Furthermore, the CPU 16 displays the created image data on the display unit 6 as live-view (step S101). In the explanation below, the aforementioned predetermined period is called a frame, the image created at this point in time is called the current frame image and the image created one frame prior to the current frame image is called the prior frame image.

[0020] When the live-view begins, the CPU 16 executes a subject tracking process (step S102). The subject tracking process includes a process that detects image regions that resemble a template image of the subject detected from the prior frame image above a predetermined threshold value, within a certain range of the region in the current frame image where the prior subject was detected. Furthermore, the subject tracking process includes a process that determines when the subject has moved within that detected image region. Detection of the subject conducted initially is accomplished with respect to the entire region of the frame image (the whole angle of view). Here, the subject is the target of imaging, and is a person, a specific part of a person (face, etc.), an animal, an object, etc.

[0021] Next, the CPU 16 determines whether or not the subject has been detected within a given range from the region where the prior subject was detected in step S102 (step S103).

[0022] When the CPU 16 determines in step S103 that the subject has been detected (step S103; Y), the CPU 16 advances to step S108. On the other hand, when the CPU 16 determines that the subject has not been detected (step S103; N), the CPU 16 partitions the prior frame image into a plurality of blocks. Next, the CPU 16 outputs optical flow indicating the distribution scene of the frame image as a whole in the flow (flow direction) of the movement vector in each of these blocks (step S104).

[0023] The CPU 16 determines the absence or presence of the movement (change in the angle of view) of the imaging apparatus 1 on the basis of the optical flow output in step S104, and detects the subject presence estimation region (the region where it is estimated that there is a high probability that the subject exists) on the basis of the determination results (step S105). Specifically, the CPU 16 detects the change in the angle of view from movement of the background and the four corners of the image in the current frame image on the basis of the optical flow output in step S104. Furthermore, the CPU 16 determines the change in the detected angle of view as being caused by movement of the imaging apparatus. Furthermore, the CPU 16 detects as the subject presence estimation region a region having a flow in a direction differing from the flow accompanying the detected movement of the imaging apparatus 1 in the current frame image.

[0024] FIG. 4 is a flowchart showing the concrete actions of steps S105 and S106. First, the CPU 16 determines whether or not the imaging apparatus 1 has moved on the basis of having detected the change in the angle of view (step S201).

[0025] When it is determined by the CPU 16 that the imaging apparatus 1 has not moved (step S201; No), in other words when the flow of the background and the four corners of the image in the current frame image are not detected, the CPU 16 then determines whether or not the subject presence estimation region was detected (step S202). When the subject presence estimation region was not detected (step S202; No), that is to say when it is determined that a region having a flow corresponding to the subject presence estimation region does not exist in the current frame image, the CPU 16 reads the normal tracking setting contents (step S203) and the tracking setting process ends.

[0026] In addition, when the subject presence estimation region was detected (step S202; Yes), in other words, when it is determined that a region exists in the current frame image having a flow corresponding to the subject presence estimation region, the detection range is expanded more than the above-described normal tracking setting contents and tracking setting is accomplished by lowering the detection threshold value (step S204) and the tracking setting process ends. The detection range is the range where matching is accomplished using the template image. This detection range is a region within a predetermined range from the region where the subject region was detected in the prior frame image. In addition, the detection threshold value is a threshold value for determining matching to the template image, and image regions with a degree of matching higher than this value are detected as subject regions. These setting values are predetermined values set in advance and are stored in a predetermined region of the program memory 14.

[0027] On the other hand, when it is determined that the imaging apparatus 1 has moved (step S201; Yes), the CPU 16 determines whether or not a region has been detected in which there is no flow accompanying movement of the imaging apparatus 1 from within the current frame image, and when this is detected judges this to be the subject presence estimation region (step S205).

[0028] When the CPU 16 determines that a subject presence estimation region has been detected (step S205; Yes), the CPU 16 then determines whether or not that subject presence estimation region has no flow in the subsequent frame images (step S206).

[0029] Furthermore, when the CPU 16 determines that the subject presence estimation region has no flow in the subsequent frame images (step S206; Yes), the detection range is expanded, a tracking setting making the detection threshold value normal is accomplished (step S207) and the tracking setting process ends.

[0030] On the other hand, when the CPU 16 determines that the subject presence estimation region has flow in the subsequent frame images (step S206; No), the detection range is expanded, tracking setting is accomplished by lowering the detection threshold value (step S204) and the tracking setting process ends.

[0031] In addition, when the CPU 16 determines that a subject presence estimation region has not been detected (step S205; No), the normal tracking setting contents are read (step S208) and the tracking setting process ends.

[0032] FIG. 5 shows a concrete example of a captured image. FIG. 5A shows the prior frame image. FIGS. 5B-5F show current frame images. In addition, FIG. 6A-6E are drawings showing concrete examples of optical flow output when FIG. 5A changes to FIGS. 5B-5F. In addition, FIG. 7 is a summary of each imaging scene and tracking setting corresponding to the output optical flows.

[0033] When the image changes from FIG. 5A to FIG. 5B, there is no movement in the positions of the subject 51 and the tree (background) 52. Hence, the optical flow output is as shown in FIG. 6A. In other words, there is no movement in the imaging apparatus 1, and there is no subject presence estimation region (step S201, No; Step S202, No). In this case, it is considered that the imaging apparatus 1 has captured a stationary subject in a fixed state as indicated by the second row in FIG. 7. Accordingly, the CPU 16 reads and sets the normal tracking setting contents (step S203).

[0034] When the image changes from FIG. 5A to FIG. 5C, the subject 51 has moved but position of the tree (background) 52 has not changed. Hence, the output optical flow is as shown in FIG. 6B and the determination is that the imaging apparatus 1 is not moving. In addition, because there is a region in FIG. 6B in which arrows are present, this region is determined to be a region in which flow is present, that is to say a subject presence estimation region (step S201, No; step S202, Yes). In this case, it is considered that this is a scene in which the imaging apparatus 1 has captured a moving subject in a fixed state as indicated by the third row in FIG. 7. Accordingly, the CPU 16 expands the detection region in order to make detection of the subject easier and accomplishes tracking setting lowering the threshold value (step S204).

[0035] When the image changes from FIG. 5A to FIG. 5D, there is no movement in the position of the subject 51 but the position of the tree (background) 52 has moved. Accordingly, the output optical flow is as shown in FIG. 6C. In this case, the imaging apparatus 1 is moving but a region with no flow accompanying movement of the imaging apparatus 1 is detected and this region is judged to be a subject presence estimation region (step S201, Yes; step S205, Yes; step S206, Yes). In this case, it is considered that this is a scene in which imaging is accomplished following a subject moving in a fixed direction such as panning, as shown in the fourth row of FIG. 7. Although the direction of the subject in the angle of view does not change in this imaging scene, it is considered that there is a possibility that the position of the subject could shift. Accordingly, the CPU 16 accomplishes tracking setting to expand the detection region with the normal threshold value (step S207).

[0036] When the image changes from FIG. 5A to FIG. 5E, the positions of the subject 51 and the tree (background) 52 are moving in the same direction. Hence, the output optical flow is as shown in FIG. 6D. That is to say, the imaging apparatus 1 is moving and it is determined that no subject presence estimation region exists (step S201, Yes; step S205, No). In this case, it is considered that this is in a scene in which the imaging apparatus 1 is capturing an image while moving with no subject present, as shown in fifth row of FIG. 7. Accordingly, the CPU 16 reads and sets the normal tracking setting contents (step S208).

[0037] When the image changes from FIG. 5A to FIG. 5F, the subject 51 and the tree (background) 52 are each moving in different directions. Hence, the output optical flow is as shown in FIG. 6E. In this case, because there is flow in a different direction (the region with different arrow direction from the surroundings in FIG. 6E) from the flow corresponding to the detected motion of the imaging apparatus 1, this region is judged to be a subject presence estimation region (step S201, Yes; step S205, Yes; step S206, No). In this case, it is considered that this is a scene in which an irregularly moving subject has not been detected, as shown in sixth row of FIG. 7. Accordingly, the CPU 16 expands the detection range in order to make detection of the subject easier and accomplishes tracking setting by lowering the threshold value (step S204). In this case, the detection range may be broader than the settings for the cases of FIGS. 5C and 5D in order to make detection of the subject even easier.

[0038] With the above-described settings, it is possible to detect and track the subject suitably.

[0039] When the tracking setting process ends, the CPU 16 returns to FIG. 3 and accomplishes the subject tracking process with the set detection range and detection threshold value (step S 107).

[0040] Furthermore, in step S108 the CPU 16 sets as the focus region the subject region detected in step S103 or step S107. Furthermore, the CPU 16 accomplishes an imaging preprocess including an auto focus (AF) process, an auto exposure (AE) process and an auto white balance (AWB) process on the set region. Next, the CPU 16 adds a frame to the detected subject region and makes a live-view display of the frame image on the display unit 6. In addition, the image of the detected subject region is updated as the new template image and the above actions are repeated. By repeating in this manner, the CPU 16 successively detects (tracks) to what position the subject is moving for the various frame images successively captured.

[0041] With the imaging apparatus 1 according to this embodiment, it is possible to accomplish subject tracking processes suitable for the imaging scenes by detecting changes in the subject and/or angle of view in the captured image.

[0042] The above-described embodiment is intended to be illustrative and not limiting, for various variations and applications are possible.

[0043] For example, when a plurality of regions are detected as subject presence estimation regions in step S105 of FIG. 3, the CPU 16 may determine as the subject presence estimation region a region within the region in which the subject was detected in the prior frame image or a region close to that region.

[0044] In addition, when the subject cannot be tracked with the subject tracking process in step S107 of FIG. 3, the CPU 16 may lower the detection threshold value in the subject presence estimation region detected in step S105 and then accomplish the subject tracking process again.

[0045] In addition, the above-described optical flow may be output by the CPU 16 taking into consideration movement vectors originating from camera-shakes. That is to say, the CPU 16 may detect movement of the imaging apparatus on the basis of optical flow output by subtracting movement vectors originating from camera-shakes detected by the camera-shake detector 17 from the output optical flow.

[0046] In addition, the program executed by the CPU 16 in the imaging apparatus 1 was explained as prerecorded in the program memory 14, but this may be acquired from an external storage medium or may be one stored after being transmitted over a network.

[0047] Having described and illustrated the principles of this application by reference to one or more preferred embodiments, it should be apparent that the preferred embodiments may be modified in arrangement and detail without departing from the principles disclosed herein and that it is intended that the application be construed as including all such modifications and variations insofar as they come within the spirit and scope of the subject matter disclosed herein.

Claims

1. An imaging apparatus **characterized by** comprising:

an imaging unit **(8);**
a determination unit **(16)** that determines an imaging scene on the basis of change between images successively captured by the imaging unit; and
a control unit **(16)** that controls tracking of a subject region included in the image captured by the imaging unit on the basis of determination results from the determination unit.

2. The imaging apparatus according to Claim 1, **characterized in that** the control unit changes a range where the subject region should be tracked in the image on the basis of the determination results from the determination unit.

3. The imaging apparatus according to Claim 1, **characterized by** further comprising:

a specification unit that specifies as the subject region corresponding to a subject that should be tracked an image region matching above a predetermined threshold value a standard image prepared from the image captured by the imaging unit in advance;

wherein the control unit includes a changing unit for changing the predetermined threshold value on the basis of the determination results from the determination unit.

4. The imaging apparatus according to Claim 3, **characterized in that** the control unit changes the predetermined threshold value to a value lower than the threshold value set immediately prior on the basis of the determination results from the determination unit.

5. The imaging apparatus according to Claim 1, **characterized in that** the determination unit includes:

a change detection unit **(16)** that detects change between the images successively captured by the imaging unit; and
a subject detection unit **(16)** that detects as the subject region a region in which there is change differing from the change detected by the change detection unit;

wherein the determination unit determines the imaging scene on the basis of detection results from the subject detection unit and detection results from the change detection unit.

6. The imaging apparatus according to Claim 5, **characterized in that**:

the determination unit determines a direction of change of an angle of view between the images on the basis of the change between the images detected by the change detection unit; and
the subject detection unit detects as the subject region a region having a direction of change differing from the direction of the change thus determined.

7. The imaging apparatus according to Claim 5, **characterized in that**:

the determination unit determines an amount of change in an angle of view between the images on the basis of the change between the images detected by the change detection unit; and
the subject detection unit detects as the subject region a region having an amount of change differing from the amount of the change thus determined.

8. The imaging apparatus according to Claim 5, **characterized in that** the subject detection unit determines whether or not a plurality of regions have been detected as subject regions, and when a plurality of regions have been detected, detects as the subject region that should be tracked a subject region detected in the region closest to the most recently tracked subject region out of that plurality of regions.

9. The imaging apparatus according to Claim 5, **characterized by** further comprising:

an output unit that outputs a vector distribution of movement vectors between the images successively captured by the imaging unit;

wherein the change detection unit detects the change between the images on the basis of the vector distribution output by the output unit; and the subject detection unit detects the subject region on the basis of the change between images detected by the change detection unit and the vector distribution output by the output unit.

10. The imaging apparatus according to Claim 9, **characterized in that** the output unit outputs the vector distribution by subtracting movement vectors caused by camera-shakes from the movement vector between the successively captured images.

11. A subject tracking method **characterized by** comprising:

an imaging step that successively captures images in an imaging unit;
a determination step that determines an imaging scene on the basis of change between the images successively captured in the imaging step; and
a control step that controls tracking of a subject region contained in the captured image on the basis of determination results from the determination step.

12. A storage medium storing a program causing an imaging apparatus' computer to function as:

a determination unit that determines an imaging scene on the basis of change between successively captured images; and
a control unit that controls tracking of a subject region contained in the image captured by an imaging unit on the basis of determination results from the determination unit.

FIG. 1A

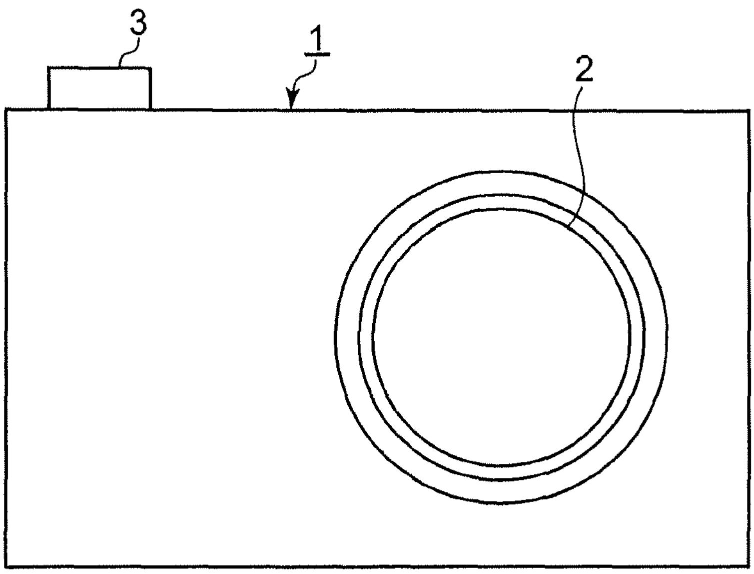


FIG. 1B

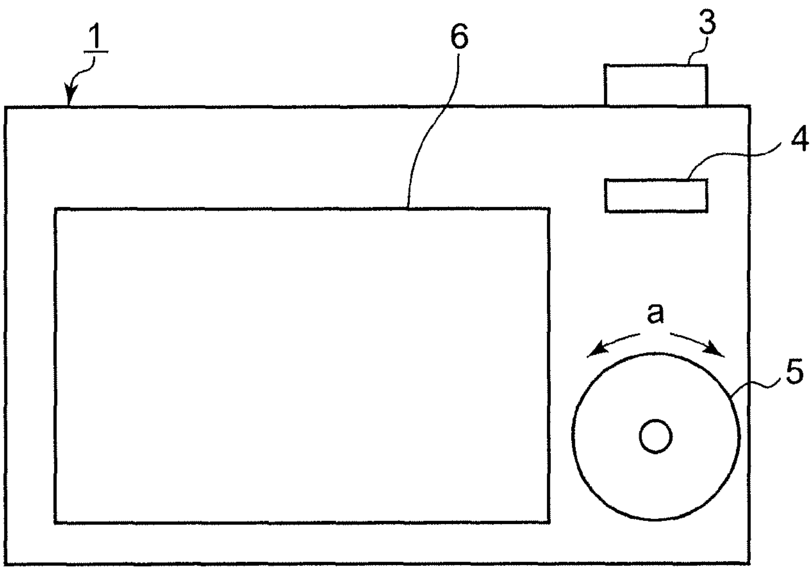


FIG. 2

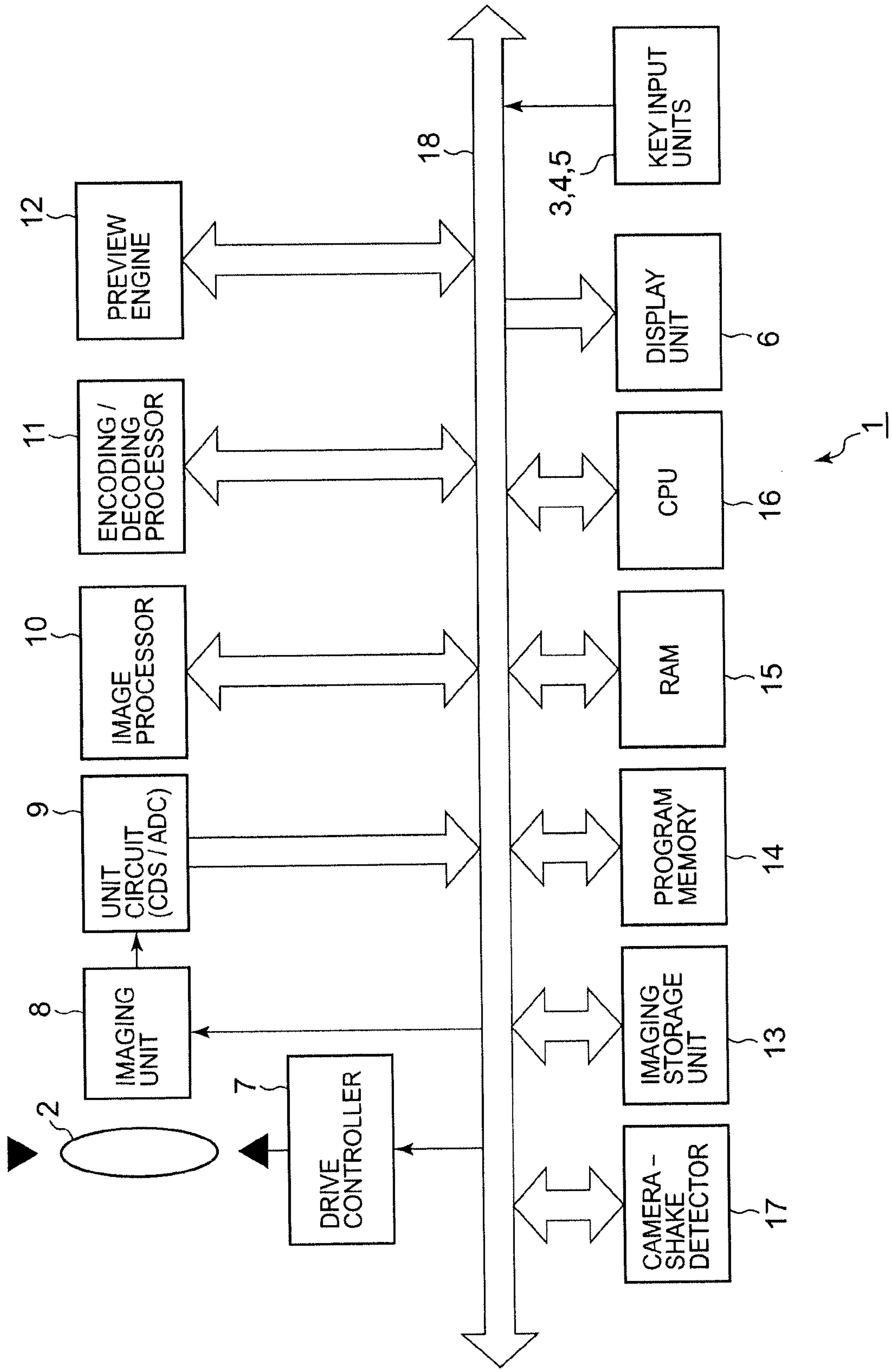

1
2
DRIVE CONTROLLER
7
IMAGING UNIT
8
UNIT CIRCUIT (CDS / ADC)
9
IMAGE PROCESSOR
10
ENCODING / DECODING PROCESSOR
11
PREVIEW ENGINE
12
18
CAMERA – SHAKE DETECTOR
17
IMAGING STORAGE UNIT
13
PROGRAM MEMORY
14
RAM
15
CPU
16
DISPLAY UNIT
6
KEY INPUT UNITS
3,4,5

FIG. 3

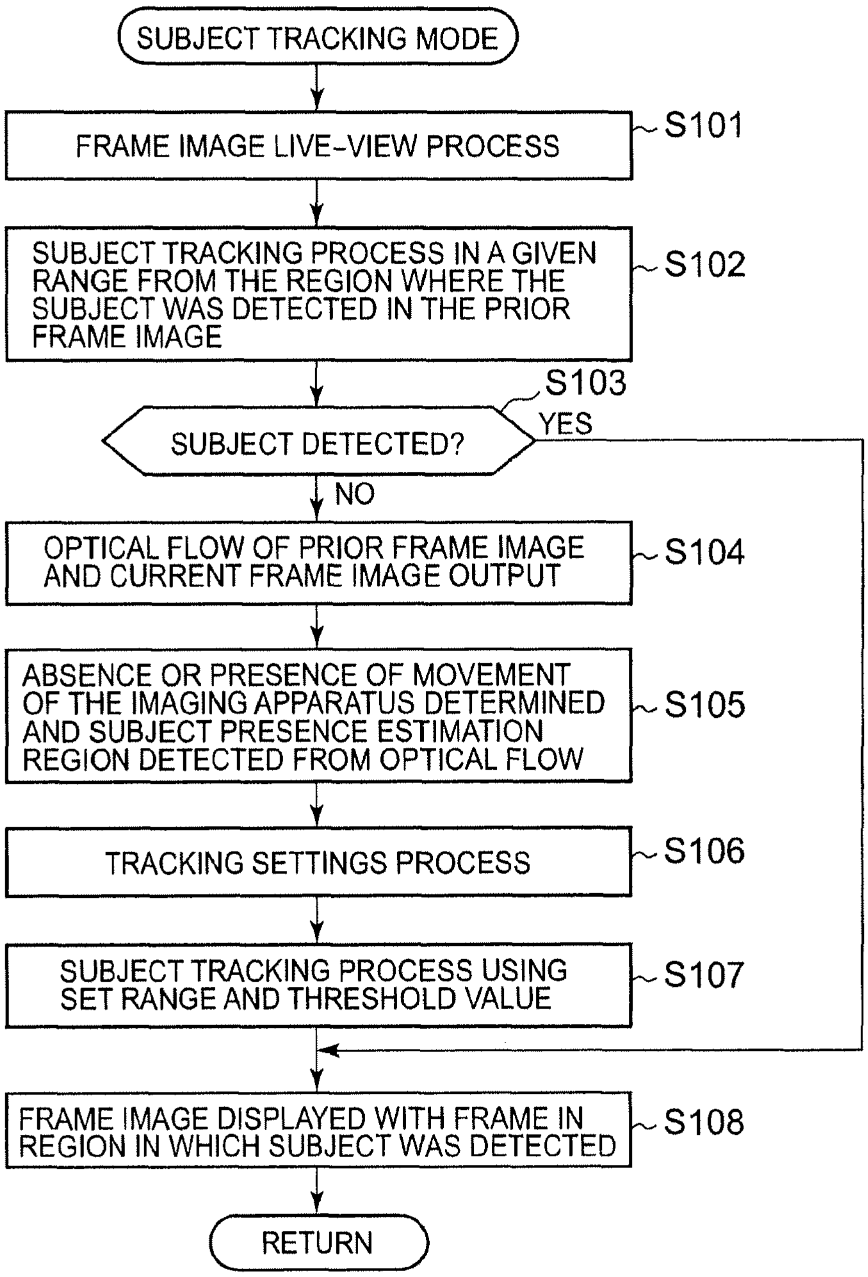

SUBJECT TRACKING MODE
FRAME IMAGE LIVE-VIEW PROCESS
S101
SUBJECT TRACKING PROCESS IN A GIVEN RANGE FROM THE REGION WHERE THE SUBJECT WAS DETECTED IN THE PRIOR FRAME IMAGE
S102
S103
SUBJECT DETECTED?
YES
NO
OPTICAL FLOW OF PRIOR FRAME IMAGE AND CURRENT FRAME IMAGE OUTPUT
S104
ABSENCE OR PRESENCE OF MOVEMENT OF THE IMAGING APPARATUS DETERMINED AND SUBJECT PRESENCE ESTIMATION REGION DETECTED FROM OPTICAL FLOW
S105
TRACKING SETTINGS PROCESS
S106
SUBJECT TRACKING PROCESS USING SET RANGE AND THRESHOLD VALUE
S107
FRAME IMAGE DISPLAYED WITH FRAME IN REGION IN WHICH SUBJECT WAS DETECTED
S108
RETURN

FIG. 4

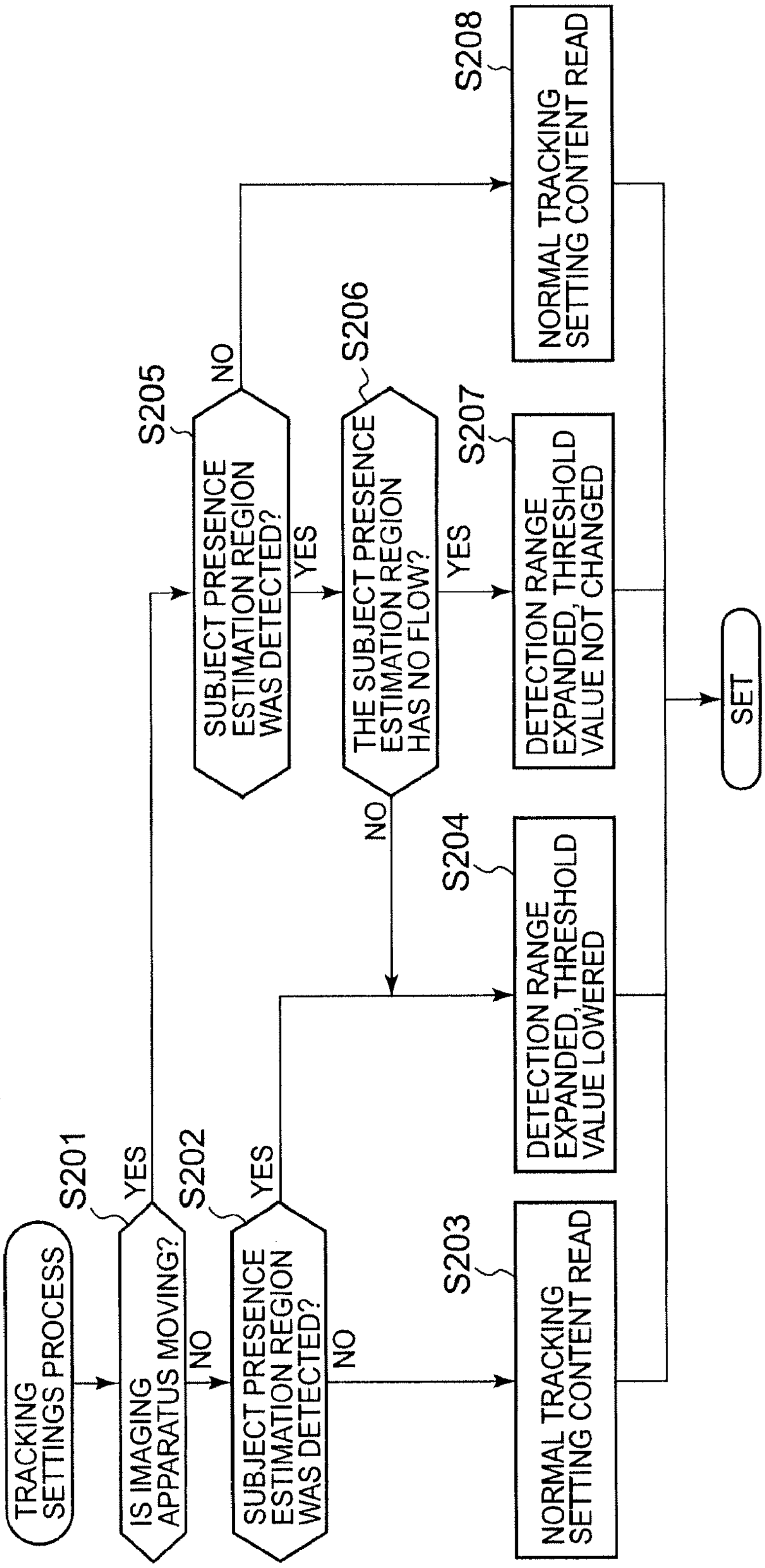

TRACKING SETTINGS PROCESS
S201
IS IMAGING APPARATUS MOVING?
YES
NO
S202
SUBJECT PRESENCE ESTIMATION REGION WAS DETECTED?
YES
NO
S203
NORMAL TRACKING SETTING CONTENT READ
S204
DETECTION RANGE EXPANDED, THRESHOLD VALUE LOWERED
S205
SUBJECT PRESENCE ESTIMATION REGION WAS DETECTED?
YES
NO
S206
THE SUBJECT PRESENCE ESTIMATION REGION HAS NO FLOW?
YES
NO
S207
DETECTION RANGE EXPANDED, THRESHOLD VALUE NOT CHANGED
S208
NORMAL TRACKING SETTING CONTENT READ
SET

FIG. 5A

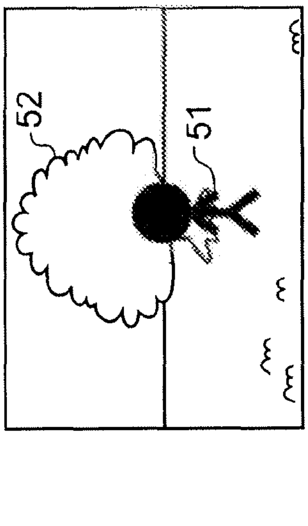


FIG. 5B

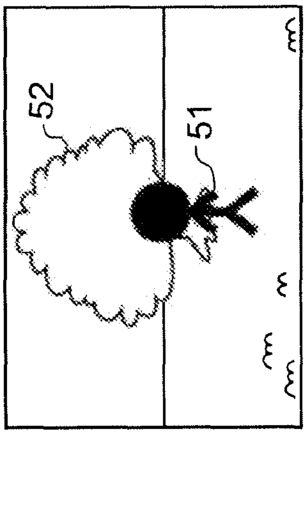


FIG. 5C

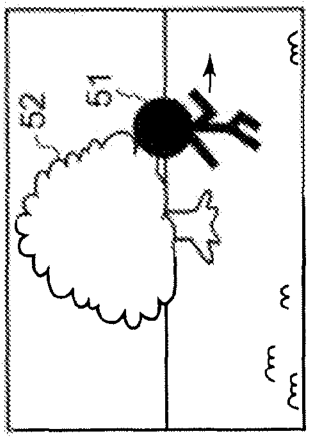


FIG. 5D

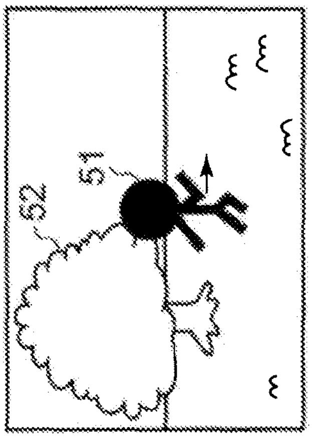


FIG. 5E

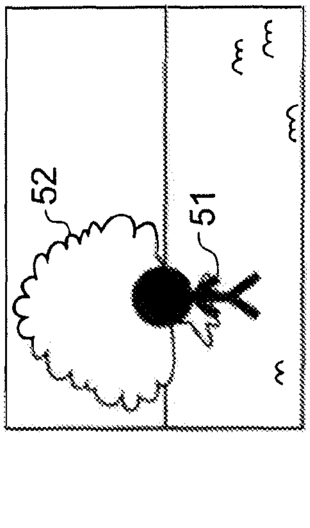
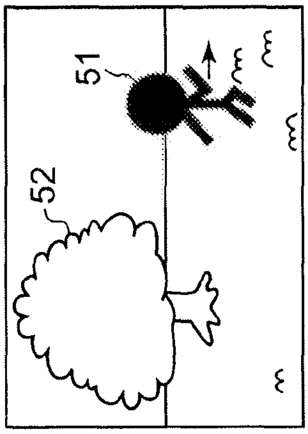


FIG. 5F



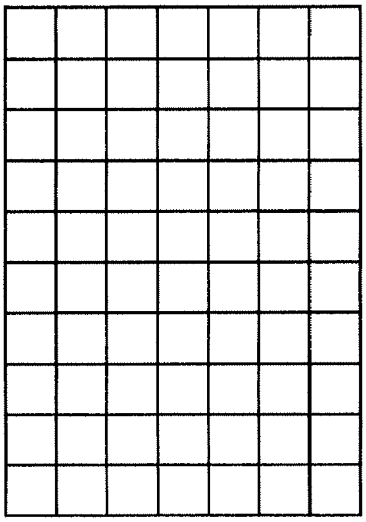


FIG. 6A

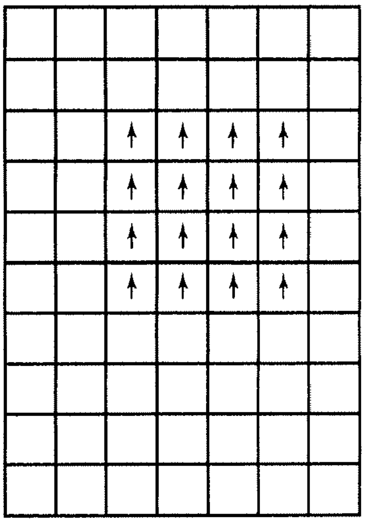


FIG. 6B

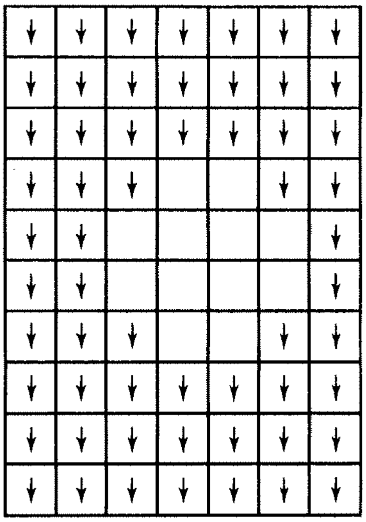


FIG. 6C

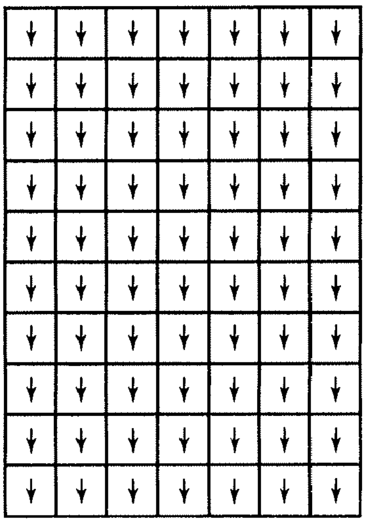


FIG. 6D

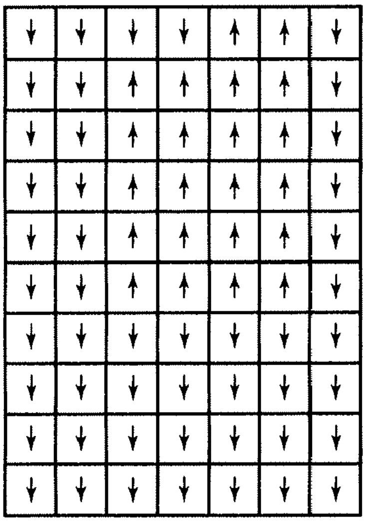


FIG. 6E

FIG. 7

	IMAGING SCENE	DETECTION RANGE	DETECTION THRESHOLD VALUE
NO IMAGING APPARATUS MOVEMENT + NO SUBJECT PRESENCE ESTIMATION REGION	STATIONARY SUBJECT CAPTURED WITH IMAGING APPARATUS FIXED	NORMAL (WITHIN A PRESCRIBED RANGE FROM THE REGION WHERE THE SUBJECT WAS INITIALLY DETECTED)	NORMAL PREDETERMINED VALUE
NO IMAGING APPARATUS MOVEMENT + SUBJECT PRESENCE ESTIMATION REGION PRESENT	MOVING SUBJECT CAPTURED WITH IMAGING APPARATUS FIXED	EXPAND THE DETECTION RANGE	LOWER THE THRESHOLD VALUE
IMAGING APPARATUS MOVEMENT + SUBJECT PRESENCE ESTIMATION REGION WITH NO FLOW	IMAGING WHILE FOLLOWING SUBJECT MOVING IN GIVEN DIRECTION	EXPAND THE DETECTION RANGE	NORMAL PREDETERMINED VALUE
IMAGING APPARATUS MOVEMENT + NO SUBJECT PRESENCE ESTIMATION REGION	STATIONARY SUBJECT CAPTURED WITH IMAGING APPARATUS NOT FIXED	NORMAL (WITHIN A PRESCRIBED RANGE FROM THE REGION WHERE THE SUBJECT WAS INITIALLY DETECTED)	NORMAL PREDETERMINED VALUE
IMAGING APPARATUS MOVEMENT + SUBJECT PRESENCE ESTIMATION REGION WITH FLOW	IMAGING WHILE FOLLOWING SUBJECT MOVING IRREGULARLY	EXPAND THE DETECTION RANGE	LOWER THE THRESHOLD VALUE

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EUROPEAN SEARCH REPORT

Application Number
EP 10 15 1353

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X	US 2006/088191 A1 (ZHANG TONG [US] ET AL) 27 April 2006 (2006-04-27) * paragraph [0025] - paragraph [0085] *	1-12	
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	20 April 2010	Rockinger, Oliver

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